CLAIMS

We claim:

1. An encoder for use in a nonvolatile counter comprising:

a logic gate having a first input for receiving an up/down signal, a
second input for receiving a most-significant bit signal;

a plus-one block having an input for receiving an inverted input signal
and an output; and

a two-to-one multiplexer having a first input for receiving the inverted
input signal, a second input coupled to the output of the plus-one block, a
control input coupled to the output of the logic gate, and an output for
providing an encoded signal.

2. The encoder of claim 1 in which the first input is set to a logic one for
counting up.

3. The encoder of claim 1 in which the first input is set to a logic zero for
counting down.

4. The encoder of claim 1 in which the logic gate comprises a XNOR
gate.

5. The encoder of claim 1 in which the plus-one block comprises a
combinatorial logic circuit.

6. The encoder of claim 1 in which the encoded signal is equal to the
inverted input signal if the control signal is a logic zero.

7. The encoder of claim 1 in which the encoded signal is equal to the
inverted input signal plus one if the control signal is a logic one.

8. The encoder of claim 1 in which the nonvolatile counter comprises a ferroelectric nonvolatile counter.

9. The encoder of claim 1 in which the nonvolatile counter comprises an *m*-bit nonvolatile counter.

10. The encoder of claim 9 in which *m* is equal to 4.

11. The encoder of claim 9 in which *m* is equal to 5.

12. The encoder of claim 9 in which *m* is equal to 40.

13. A method for encoding an input number *n* comprising:

if *n* is even, providing a conventional binary code of ($n/2$); and

if *n* is odd, providing a complementary binary code of ((n-1)/2).

14. A method for encoding an input signal to an output signal comprising switching all of the bits in the output signal to the logical compliment when counting from an even number to an odd number.

15. A method for counting up from an input number
$n = d_m d_{m-1} d_{m-2}...d_1 d_0$ comprising:

if n is even, then $n+1 = \bar{d}_m \bar{d}_{m-1} \bar{d}_{m-2}...\bar{d}_1 \bar{d}_0$; and

if n is odd, then $n+1 = \bar{d}_m \bar{d}_{m-1} \bar{d}_{m-2}...\bar{d}_1 \bar{d}_0 + 1$.

16. The method of claim 15 further comprising keeping an output count at a maximal number when counting up from the maximal number instead of rolling the output count over to zero.

17. The method of claim 16 in which the maximal number is equal to 1000 when m is equal to four.

18. A method for counting down from an input number $n = d_m d_{m-1} d_{m-2} ... d_1 d_0$ comprising:

5   if n is even, then $n-1 = \overline{d}_m \overline{d}_{m-1} \overline{d}_{m-2} ... \overline{d}_1 \overline{d}_0 + 1$; and

        if n is odd, then $n-1 = \overline{d}_m \overline{d}_{m-1} \overline{d}_{m-2} ... \overline{d}_1 \overline{d}_0$.

19. The method of claim 18 further comprising keeping an output count at zero when counting down from zero, instead of rolling the output count over to a maximal number.

10   20. The method of claim 18 in which the maximal number is equal to 1000 when m is equal to four.